1
00:00:01,510 --> 00:00:05,630
\h GEORGE DILLER: Mars... Our planetary neighbor has long intrigued us

2
00:00:05,630 --> 00:00:10,800
\h and invited speculation about whether life exists there. Recent successful

3
00:00:10,800 --> 00:00:15,150
\h missions like NASA’s Mars rovers have yielded increasing knowledge about

4
00:00:15,150 --> 00:00:20,810
\h the red planet's geology and history. Now, a new space explorer is waiting in

5
00:00:20,810 --> 00:00:27,260
\h the wings and ready to take center stage: the Mars lander called Phoenix.

6
00:00:27,260 --> 00:00:31,800
\h Set for launch aboard a Delta II rocket, Phoenix will dig through the Martian

7
00:00:31,800 --> 00:00:37,140
\h soil and ice in the arctic region using a robotic arm. Phoenix will use its

8
00:00:37,140 --> 00:00:42,330
\h onboard scientific instruments to analyze the samples it retrieves.

9
00:00:42,330 --> 00:00:47,150
\h By using the Deep Space Network tracking stations, scientists on Earth will be able to

10
00:00:47,150 --> 00:00:51,630
\h communicate with the spacecraft. They hope to learn more about existing

11
00:00:51,630 --> 00:00:58,490
\h water on the planet, as well as search for any signs that some form of life could exist there.

12
00:00:58,490 --> 00:01:01,510
\h The Phoenix mission should take us one step closer to the

13
00:01:01,510 --> 00:01:06,550

\h goal of someday conducting human exploration of Mars. Join us now at the

14
00:01:06,550 --> 00:01:10,860
\h Kennedy Space Center in Florida as we take an in-depth look at preparations

15
00:01:10,860 --> 00:01:16,940
\h for the launch, and learn about the science of our next mission to Mars, Phoenix.

16
00:01:16,940 --> 00:01:48,300
\h Music.

17
00:01:48,300 --> 00:01:51,160
\h TIFFANY NAIL: Welcome to the Phoenix webcast. I'm your host,

18
00:01:51,160 --> 00:01:57,130
\h Tiffany Nail. Today, we're going to take you out of the studio and into the field to

19
00:01:57,130 --> 00:02:01,930
\h show you where all the action takes place in the weeks leading up to liftoff.

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00:02:01,930 --> 00:02:05,510
\h You'll see how the rocket takes shape at the launch pad as the spacecraft

21
00:02:05,510 --> 00:02:11,960
\h undergoes its final tests just a few miles away. So let's get started. Our

22
00:02:11,960 --> 00:02:15,610
\h mission manager, Ron Mueller, is going to join me at the clean room where

23
00:02:15,610 --> 00:02:20,370
\h the Phoenix lander is being prepared for launch. But first, here's Ron to tell

24
00:02:20,370 --> 00:02:25,740
\h us a little more about the spacecraft.

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00:02:25,740 --> 00:02:28,220
\h RON MUELLER: The last stop on Earth for the Phoenix spacecraft is

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00:02:28,220 --> 00:02:32,560
\h NASA's Kennedy Space Center in Florida. Built in Colorado by Lockheed

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00:02:32,560 --> 00:02:36,310
\h Martin Space Systems, Phoenix arrived at the space center's Shuttle Landing

28
00:02:36,310 --> 00:02:41,480
\h Facility aboard a U.S. Air Force C-17. From there, it was transported to a

29
00:02:41,480 --> 00:02:45,760
\h clean room at the Payload Hazardous Servicing Facility for preflight testing.

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00:02:45,760 --> 00:02:50,180
\h The final checkouts include spin-balance testing with and without fuel,

31
00:02:50,180 --> 00:02:54,500
\h testing the heat shield separation, verifying the launch and cruise stage

32
00:02:54,500 --> 00:02:59,290
\h systems, and conducting solar array deployment and lighting tests.

33
00:02:59,290 --> 00:03:02,600
\h Workers loaded flight software and performed compatibility testing with the

34
00:03:02,600 --> 00:03:06,760
\h Deep Space Network. The parachute that will slow the spacecraft's descent

35
00:03:06,760 --> 00:03:10,400
\h through the thin Martian atmosphere was installed, and the electrical power

36
00:03:10,400 --> 00:03:14,930
\h system was put through a final performance test. The landing radar was

37
00:03:14,930 --> 00:03:19,820
\h integrated and the entry, descent and landing system verified. Following all

38
00:03:19,820 --> 00:03:24,280

\h the tests, the spacecraft can then be installed on the third stage before

39
00:03:24,280 --> 00:03:28,190
\h moving to the launch pad in a transportation canister.

40
00:03:28,190 --> 00:03:29,720
\h With the third stage attached to the

41
00:03:29,720 --> 00:03:32,900
\h Delta II rocket and covered with a protective fairing,

42
00:03:32,900 --> 00:03:38,960
\h Phoenix will await liftoff on its exciting journey to Mars.

43
00:03:38,960 --> 00:03:43,060
\h NAIL: I'm here now in the Payload Hazardous Servicing Facility with Ron Mueller.

44
00:03:43,060 --> 00:03:44,120
\h Thanks for joining me, Ron.

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00:03:44,120 --> 00:03:45,400
\h MUELLER: Good to be here, Tiffany.

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00:03:45,400 --> 00:03:49,120
\h NAIL: Ron, could you explain to us your role as mission manager for Phoenix?

47
00:03:49,120 --> 00:03:52,120
\h MUELLER: Sure. As mission manager, I work with the spacecraft team and

48
00:03:52,120 --> 00:03:55,170
\h the launch vehicle team here at Kennedy Space Center to ensure that the

49
00:03:55,170 --> 00:04:00,450
\h spacecraft is designed and tested to withstand the environment during launch

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00:04:00,450 --> 00:04:04,440
\h and prepare all the steps along the way so that everything is readied for launch.

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00:04:04,440 --> 00:04:08,890
\h NAIL: Ron, one of our viewers, Justin from Flint, asked, "How do we get

52
00:04:08,890 --> 00:04:12,920
\h the lander out to the launch pad and up on top of the rocket?"

53
00:04:12,920 --> 00:04:16,070
\h MUELLER: The first step in moving the spacecraft out to the launch pad is

54
00:04:16,070 --> 00:04:19,200
\h to bring the third stage of the launch vehicle here to the PHSF. The

55
00:04:19,200 --> 00:04:21,760
\h spacecraft will be mounted to that third stage.

56
00:04:21,760 --> 00:04:24,920
\h That stack will be encapsulated and then transported out to the launch pad,

57
00:04:24,920 --> 00:04:26,980
\h where the rest ofthe vehicle awaits.

58
00:04:26,980 --> 00:04:30,400
\h NAIL: Jessica from Denver wanted to know what protects Phoenix from

59
00:04:30,400 --> 00:04:32,670
\h getting damaged during the launch.

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00:04:32,670 --> 00:04:35,340
\h MUELLER: To protect the spacecraft from damage during launch, we first

61
00:04:35,340 --> 00:04:38,490
\h do a lot of analysis and testing to ensure that the spacecraft is designed to

62
00:04:38,490 --> 00:04:41,730
\h meet that environment. Additionally, there's a fairing on the launch vehicle

63
00:04:41,730 --> 00:04:44,660

\h that helps protect the spacecraft during the launch phase.

64
00:04:44,660 --> 00:04:46,670
\h NAIL: Ron, thanks for joining me outside the clean room.

65
00:04:46,670 --> 00:04:48,930
\h MUELLER: You're welcome.

66
00:04:48,930 --> 00:04:52,110
\h NAIL: While final preparations are under way here on the spacecraft, the

67
00:04:52,110 --> 00:04:56,520
\h rocket that will carry it is being readied just a few miles away at Launch Pad

68
00:04:56,520 --> 00:05:01,220
\h 17-A. Before Launch Manager Chuck Dovale joins me at the pad, here's our

69
00:05:01,220 --> 00:05:09,980
\h deputy chief engineer, Dave Sollberger, to tell us how the rocket is prepared for launch.

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00:05:09,980 --> 00:05:12,200
\h DAVE SOLLBERGER: The launch vehicle that will carry the Phoenix

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00:05:12,200 --> 00:05:16,730
\h spacecraft on the first leg of its journey to Mars is the Delta II rocket.

72
00:05:16,730 --> 00:05:23,070
\h Deltas have been carrying NASA spacecraft aloft since the 1960s, and today's Delta

73
00:05:23,070 --> 00:05:29,520
\h II has a long history of successful launches. Unlike the space shuttle, which

74
00:05:29,520 --> 00:05:35,020
\h is moved to the launch pad fully assembled, the Delta II is erected on the pad

75
00:05:35,020 --> 00:05:39,860
\h in stages. In a hangar at Cape Canaveral Air Force Station, workers prepare

76
00:05:39,860 --> 00:05:44,540
\h and test the first and second stages of the rocket before moving them to the

77
00:05:44,540 --> 00:05:50,220
\h launch pad. Once the first stage is hoisted into place on the pad, the nine

78
00:05:50,220 --> 00:05:54,960
\h solid rocket boosters that will help propel the Delta II are attached. Workers

79
00:05:54,960 --> 00:06:00,360
\h then raise the second stage atop the first, as the powerful launch vehicle

80
00:06:00,360 --> 00:06:04,480
\h takes shape. In the final days before launch, the spacecraft is attached to the

81
00:06:04,480 --> 00:06:10,350
\h upper-stage booster before moving to the launch pad in a transport canister.

82
00:06:10,350 --> 00:06:14,580
\h Once the spacecraft is mounted atop the rocket and covered with its

83
00:06:14,580 --> 00:06:18,670
\h protective fairing, the Delta II awaits its thunderous liftoff and the beginning

84
00:06:18,670 --> 00:06:24,720
\h of another exciting mission to Mars.

85
00:06:24,720 --> 00:06:28,460
\h NAIL: I'm here at Launch Pad-17A with Phoenix Launch Manager Chuck

86
00:06:28,460 --> 00:06:29,700
\h Dovale. Chuck, thanks for joining us.

87
00:06:29,700 --> 00:06:31,450
\h CHUCK DOVALE: Thanks, Tiffany. It's a pleasure to be here.

88
00:06:31,450 --> 00:06:34,670

\h NAIL: Chuck, Can you tell us what work is going on behind us here?

89
00:06:34,670 --> 00:06:37,230
\h DOVALE: We're to the point of testing the launch vehicle on the pad. We've

90
00:06:37,230 --> 00:06:41,380
\h got the first and second stage mated and we'll run through a series of

91
00:06:41,380 --> 00:06:45,640
\h electrical and mechanical checks before we do a simulated flight.

92
00:06:45,640 --> 00:06:49,870
\h We'll load the first stage with liquid oxygen, make sure that the tank system is sound

93
00:06:49,870 --> 00:06:54,350
\h and willing to take cryogenic temperatures. It's all in preparation for the

94
00:06:54,350 --> 00:06:58,710
\h spacecraft and its third stage to roll out. Once we roll them out and mate

95
00:06:58,710 --> 00:07:03,180
\h them to the launch vehicle, we'll perform an integrated test, make sure that

96
00:07:03,180 --> 00:07:06,300
\h the launch vehicle and the spacecraft are working well together,

97
00:07:06,300 --> 00:07:08,830
\h and that's all in preparation for countdown.

98
00:07:08,830 --> 00:07:11,440
\h NAIL: Chuck, I have two questions from our viewers. Timothy from

99
00:07:11,440 --> 00:07:16,830
\h Springfield would like to know, "Why does a Delta II rocket need so many boosters?"

100
00:07:16,830 --> 00:07:19,920
\h DOVALE: It's all about performance -- how much does the spacecraft weigh

101
00:07:19,920 --> 00:07:24,470
\h and where's it going? So in the case of Phoenix, it's a fairly heavy spacecraft

102
00:07:24,470 --> 00:07:29,360
\h and it's going to Mars. So we needed a vehicle that would be able to lift off

103
00:07:29,360 --> 00:07:34,440
\h the ground with Phoenix and take it through Earth's gravitational

104
00:07:34,440 --> 00:07:37,160
\h pull and head on to Mars.

105
00:07:37,160 --> 00:07:40,410
\h NAIL: Kevin from Bowling Green would like to know what makes a Delta

106
00:07:40,410 --> 00:07:43,550
\h II rocket the right one to carry the Phoenix spacecraft.

107
00:07:43,550 --> 00:07:46,320
\h DOVALE: We look at three things when we're evaluating a mission.

108
00:07:46,320 --> 00:07:51,580
\h We look at cost effectiveness. We look at past performance and capability of the

109
00:07:51,580 --> 00:07:56,710
\h launch vehicle. Can it lift the mass that we have and take it to the proper

110
00:07:56,710 --> 00:08:01,090
\h orbit? In the case of Phoenix, we looked at that and this particular

111
00:08:01,090 --> 00:08:04,710
\h configuration of the Delta II was a perfect match for Phoenix.

112
00:08:04,710 --> 00:08:07,230
\h NAIL: Well, thanks, Chuck, for joining us and good luck on launch day.

113
00:08:07,230 --> 00:08:09,770

\h DOVALE: Thanks, Tiffany.

114
00:08:09,770 --> 00:08:12,400
\h NAIL: Phoenix principal investigator Peter Smith from the University of

115
00:08:12,400 --> 00:08:16,670
\h Arizona has graciously agreed to answer some additional viewer

116
00:08:16,670 --> 00:08:23,270
\h Questions about the science of the mission. Here's Peter.

117
00:08:23,270 --> 00:08:26,590
\h PETER SMITH: My name is Peter Smith. I'm the principal investigator of

118
00:08:26,590 --> 00:08:32,700
\h the next mission to Mars called the Phoenix mission. Phoenix is going to

119
00:08:32,700 --> 00:08:37,520
\h Mars to an arctic region to investigate a discovery made in 2002 by the

120
00:08:37,520 --> 00:08:43,010
\h Odyssey spacecraft that the arctic region has ice near the surface,

121
00:08:43,010 --> 00:08:47,480
\h surrounding the actual exposed polar cap. In other words, it's sort of a

122
00:08:47,480 --> 00:08:52,100
\h permafrost region on Mars that was only recently discovered and whose

123
00:08:52,100 --> 00:08:56,460
\h properties are totally unknown. So Phoenix is a voyage of exploration and

124
00:08:56,460 --> 00:09:02,600
\h discovery. Putting the spacecraft down on one of the colder parts of Mars is

125
00:09:02,600 --> 00:09:07,930
\h really something that has stressed our engineering team, and so we've had to

126
00:09:07,930 --> 00:09:13,190
\h come up with a well-insulated container to hold our electronics, which only

127
00:09:13,190 --> 00:09:17,570
\h work down to certain temperatures, and then we put in heaters to keep those

128
00:09:17,570 --> 00:09:21,820
\h electronics above that temperature at all times. Now of course, this takes

129
00:09:21,820 --> 00:09:27,750
\h some of our solar power, and as winter comes to the spacecraft and the sun

130
00:09:27,750 --> 00:09:33,030
\h sets, it gets extremely cold -- so cold that it actually freezes out the carbon

131
00:09:33,030 --> 00:09:37,710
\h dioxide atmosphere into dry ice. And you get a layer of dry ice that actually

132
00:09:37,710 --> 00:09:42,300
\h encases the spacecraft, and no solar energy for the heaters. And so, at that

133
00:09:42,300 --> 00:09:48,040
\h point, the electronics would be stressed past the point where they're

134
00:09:48,040 --> 00:09:53,000
\h guaranteed to work and it'd be a miracle if they survive through that winter,

135
00:09:53,000 --> 00:09:55,350
\h but we may try and listen in the spring and summer of the next year just to

136
00:09:55,350 --> 00:10:07,630
\h see if it did. I suspect it won't. The robot arm is very strong. If, if you were

137
00:10:07,630 --> 00:10:11,040
\h to brace your legs and hold on to that arm and try and stop it from moving, it

138
00:10:11,040 --> 00:10:14,680

\h would drag you. So it's a strong arm. It may actually even move the

139
00:10:14,680 --> 00:10:19,980
\h spacecraft. So we feel very confident we can get through even very hard-

140
00:10:19,980 --> 00:10:26,440
\h packed soils. Now when we get to the very cold ice that's almost a pure ice,

141
00:10:26,440 --> 00:10:31,390
\h it's the hardness almost of granite. And so we've put a power tool on the end

142
00:10:31,390 --> 00:10:39,270
\h of the arm that actually acts as a rasp, and it spins and it throws pieces of ice

143
00:10:39,270 --> 00:10:42,330
\h chips inside of the back of our scoop, and we can deliver those to our

144
00:10:42,330 --> 00:10:45,530
\h instruments. So we are sure that we'll get a sample of even the hardest

145
00:10:45,530 --> 00:10:54,530
\h materials. NASA developed airbags as part of the Pathfinder mission and

146
00:10:54,530 --> 00:10:59,040
\h decided to use them again for the Mars rovers. However, the spacecraft we

147
00:10:59,040 --> 00:11:04,550
\h have inherited was designed before Pathfinder was successful (its propulsion

148
00:11:04,550 --> 00:11:09,410
\h system was designed). And so we've gone back to the, the landing system of

149
00:11:09,410 --> 00:11:14,430
\h the Vikings, the two Vikings, which is using thrusters, and we feel that we're

150
00:11:14,430 --> 00:11:19,230
\h very safe using thrusters. And in fact, for us to use airbags would have to

151
00:11:19,230 --> 00:11:25,110
\h reduce the mass of our spacecraft and that would be, mean less science and

152
00:11:25,110 --> 00:11:32,090
\h less capability, so we're very happy with thrusters. The closest we've ever

153
00:11:32,090 --> 00:11:38,030
\h been to the polar regions with a lander, a successful lander, was Viking II,

154
00:11:38,030 --> 00:11:43,430
\h and it landed about 45 degrees north latitude. On the Earth, that would be

155
00:11:43,430 --> 00:11:48,210
\h somewhere near Chicago, I think, and very far from northern Canada or

156
00:11:48,210 --> 00:11:52,060
\h northern Greenland, which is the latitudes we're going to (using an Earth

157
00:11:52,060 --> 00:11:57,380
\h analog). Now there was an attempt to get to the polar regions in 1999 with

158
00:11:57,380 --> 00:12:02,410
\h Mars Polar Lander; unfortunately, it failed to land safely. And we are

159
00:12:02,410 --> 00:12:06,610
\h actually reusing some of the instruments that were on that mission and,

160
00:12:06,610 --> 00:12:13,360
\h hopefully, we will have success this time, and that's really the reason for the

161
00:12:13,360 --> 00:12:17,970
\h name "Phoenix." Phoenix is a long-lived bird that dies in flames and is

162
00:12:17,970 --> 00:12:26,460
\h reborn from its ashes, so it's a symbol of rebirth.

163
00:12:26,460 --> 00:12:29,980

\h NAIL: I hope you enjoyed the program. I want to thank our guests for giving

164
00:12:29,980 --> 00:12:35,770
\h us this inside look at what goes into a successful launch and mission. Join us